

**Agreement between California Energy Commission
and
American Biodiesel, Inc. dba Community Fuels**

Title: Integrated system for reducing water consumption and wastewater discharge of biodiesel production facilities in California
Amount: \$349,524.00
Term: 30 months
PIER Contact: Anish Gautam
RD&D Committee: 12/3/2009

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Electric	IAW	Energy Efficiency	\$2,000,000	\$349,524	\$233,012	11%

For the 2009 fiscal year, the total Electric budget is \$62.5 million. Within the Electric program, the IAW program area budget is \$2.75 million and, from this amount, \$2 million was allocated to the Energy Efficiency budget initiative. If approved, the remaining initiative balance will be \$233,012.

Recommendation

Approve this agreement with American Biodiesel, Inc. dba Community Fuels for \$349,524.00, with \$179,556.00 in match funding. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

The Problem

Biodiesel is a clean-burning, renewable fuel produced from agricultural sources (such as vegetable oils and animal fats) that can be blended at any level with petroleum diesel and used by most compression-ignition (diesel) engines with few or no modifications. The biodiesel industry in California is growing rapidly, with total production by California facilities is currently estimated at 47 million gallons per year. This increase in biodiesel production brings with it associated concerns about potential increases in water consumption and wastewater discharge related to its production. Conventional biodiesel production processes require a water wash step to remove polar impurities (i.e., glycerol, soaps, methanol and salts) from the crude biodiesel product. Between 0.4 and 2 gallons of wash water are typically utilized for every gallon of biodiesel processed, and the spent wash water constitutes a waste stream high in biological oxygen demand (BOD) and total dissolved solids (TDS).

While “waterless wash” systems have been proposed for biodiesel production (i.e., using a solid adsorbent instead of water to remove impurities from the crude biodiesel), drawbacks include the consumption of costly adsorbent material, added operational complexity, increased hazard of explosion, inadvertent product loss, and the need to dispose of spent adsorbent. While water washing remains the most effective and economical method of removing polar impurities from crude biodiesel, technologies that mitigate the issues of high water consumption and wastewater generation need to be developed.

Proposed Research

The proposed water treatment system will integrate three distinct components consisting of distillation, ultrafiltration and reverse osmosis technologies, for treating and recycling spent biodiesel wash water. This system will reduce the consumption of water for biodiesel washing by an estimated 85% and result in a zero-discharge wash process. It will constitute the first industrial-scale demonstration of these combined technologies applied to treating effluent from biodiesel production.

During the ultrafiltration step spent wash water will be circulated through an ultrafiltration membrane to remove soaps, residual oils, and emulsified solids, which would interfere with the functioning of the downstream system components. The permeate received from the ultrafiltration unit will be pumped through a reverse osmosis membrane to remove dissolved salts and glycerol. The reverse osmosis permeate contains methanol as the only major contaminant remaining in the water, and the RO permeate will be sent to a distillation/stripping column for methanol removal. The purified water collected from the distillation/stripping column will be recovered and recycled back in the biodiesel wash process.

As part of the M&V plan required by the solicitation, the water fluxes and energy consumption (electricity and gas) will be monitored and recorded continuously by the existing PLC system at the facility. Water and fuel quality will be monitored by analyses of discrete samples collected regularly from different points in the process during operations.

Research Justification and Goals

This project "[will develop, and help bring to market] increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers" (Public Resources Code 25620.1.(b)(2)), (Chapter 512, Statutes of 2006)); and supports California's goal to evaluate and conduct research to better understand the interaction of water and energy within the state and identify new and innovative technologies and measures for achieving energy and water efficiency savings per the Integrated Energy Policy Report 2005 by:

- Integrate and demonstrate three distinct components consisting of distillation, ultrafiltration and reverse osmosis technologies for treating and recycling spent biodiesel wash water.
- Reduce the consumption of water for biodiesel washing by an estimated 85% and result in a zero-discharge wash process.

Background

The proposal was submitted through competitive solicitation, Emerging Technology Demonstrations Grants Program (ETDG) Opportunity Notice 08-006. This opportunity notice was structured to solicit proposals under four categories 1) Data Center, 2) Energy Storage, 3) Industrial Energy Efficiency and 4) Water and Wastewater. This proposal tied for rank 5 out of 12 proposals received through the solicitation under the Water and Wastewater category.

The potential facilities for full-scale commercial installation of this technology include all biodiesel production facilities in California (both newly constructed facilities as well as retrofits of existing facilities) that use a water wash step for purifying the crude biodiesel product. Biodiesel production is expected to increase significantly in the State in response to current and pending State legislation. This

includes Assembly Bill 32, which was passed in 2006 with the goal of reducing greenhouse gas emissions statewide below 1990 levels by 2020, and Executive Order S-01-07, which established a Low-Carbon Fuel Standard for transportation fuels in California. As biodiesel can be used with existing industrial equipment and infrastructure, it offers California businesses an immediate and relatively inexpensive means of reducing their greenhouse gas emissions to attain targeted reduction levels. In addition, a non-petroleum diesel fuel blending requirement is being considered in California (*e.g.*, the California Energy Commission's 2005 Integrated Energy Policy Report recommended that all diesel fuel sold in California should be required to contain a minimum of 5% non-petroleum content), following the precedent set by similar mandates for minimum biodiesel blend levels established in Minnesota, Washington, Pennsylvania and Oregon and currently being planned in several other states. At a 5% blend level, the current biodiesel demand in California would be approximately 200 million gallons per year and the projected demand in 2030 would be 333-414 million gallons per year.

The proposed project will be the first demonstration of these combined technologies applied to the specific requirements and challenges associated with treating effluent from biodiesel production. The project constitutes an industrial-scale demonstration directly relevant to commercialization of this technology in California's biodiesel industry and will provide prospective adopters with convincing evidence that the system can be installed and operated cost-effectively and will maintain product quality relative to biodiesel washed with non-recycled water. The finished biodiesel produced using recycled wash water is of comparable quality to biodiesel produced using new wash water and meets all ASTM D6751 fuel quality specifications for biodiesel (B100).

The site for the proposed project will be the 10 MMgal/yr biodiesel production facility operated by Community Fuels at Port of Stockton, CA. The existing infrastructure (installation pads, support and access structures, etc.), utilities service, and permitting currently in place at the Community Fuels facility will make it feasible to install and operate the equipment encompassed by the technology demonstration project in a timely and efficient manner.